

SPIN-ENTANGLED CURRENTS CREATED BY A TRIPLE QUANTUM DOT

Daniel Saraga and Daniel Loss

Department of Physics and Astronomy

University of Basel, Klingelbergstrasse 82 CH-4056 Basel, Switzerland

We propose a simple setup of three quantum dots in the Coulomb blockade regime as a source for spatially separated currents of spin-entangled electrons. The singlet ground state of a quantum dot with an even number of electrons provides a pair of entangled electrons. To preserve the entanglement during the electron transport to the drain leads, we use secondary dots as energy filters. This prevents one-electron transport by energy mismatch, while joint transport is enhanced by a resonance of the total two-electron energy.

We derive precise conditions on the physical parameters needed for an efficient creation of entangled electronic currents. These parameters correspond to typical transport experiments involving quantum dots. Our proposed setup is based on existing technology, and could be realized with lateral or vertical quantum dots, as well as carbon nanotubes.